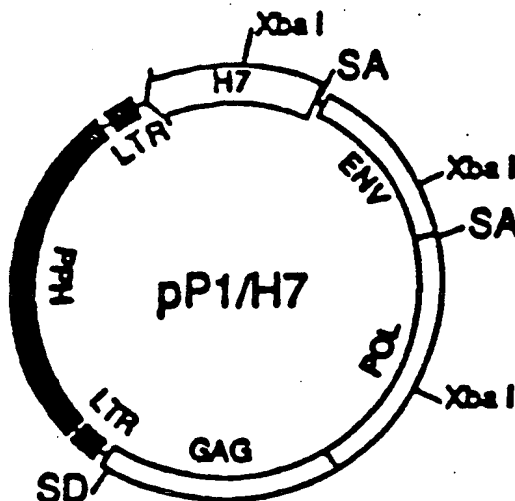




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(54) Title: IMMUNIZATION BY INOCULATION OF DNA TRANSCRIPTION UNIT



(57) Abstract

This invention relates to a method of immunizing a vertebrate, comprising introducing into the vertebrate a DNA transcription unit which comprises DNA encoding a desired antigen or antigens. The uptake of the DNA transcription unit by a host vertebrate results in the expression of the desired antigen or antigens, thereby eliciting humoral or cell-mediated immune responses or both humoral and cell-mediated responses. The elicited humoral and cell-mediated immune response can provide protection against infection by pathogenic agents, provide an anti-tumor response, or provide contraception. The host can be any vertebrate, avian or mammal, including humans.

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IMMUNIZATION BY INOCULATION OF DNA
TRANSCRIPTION UNIT

Background of the Invention

Vaccination with inactivated or attenuated organisms
5 or their products has been shown to be an effective method
for increasing host resistance and ultimately has led to
the eradication of certain common and serious infectious
diseases. The use of vaccines is based on the stimulation
of specific immune response within a host or the transfer
10 of preformed antibodies. The prevention of certain
diseases, such as poliomyelitis, by vaccines represents
one of immunologies greatest triumphs.

Effective vaccines have been developed for relatively
few of the infectious agents that cause disease in
15 domestic animals and man. This reflects technical
problems associated with the growth and attenuation of
virulent strains of pathogens. Recently effort has been
placed on the development of subunit vaccines (vaccines
that present only selected antigens from a pathogen to the
20 host). Subunit vaccines have the potential for achieving
high levels of protection in the virtual absence of side
effects. Subunit vaccines also offer the opportunity for
the development of vaccines that are stable, easy to
administer, and sufficiently cost-effective for widespread
25 distribution.

Summary of the Invention

This invention relates to a method of immunizing an
individual, comprising introducing into the individual a
DNA transcription unit which comprises DNA encoding a
30 desired antigen or antigens. The uptake of the DNA
transcription unit by host cells results in the expression
of the desired antigen or antigens, thereby eliciting

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humoral or cell-mediated immune responses or both humoral and cell-mediated responses. The elicited humoral and cell-mediated immune response can provide protection against infection by pathogenic agents, provide an anti-tumor response, or provide contraception. The host can be any vertebrate, avian or mammal, including humans.

The present invention relates in a particular embodiment to a method of immunizing an individual by contacting a mucosal surface in the individual with a DNA transcription unit capable of expressing a desired antigen or antigen.

The DNA transcription unit introduced by the present method can be used to express any antigen encoded by an infectious agent, such as a virus, a bacterium, a fungus, or a parasite, as well as antigenic fragments and peptides that have been experimentally determined to be effective in immunizing an individual against infection by a pathogenic agent. As stated above, DNA transcription units can also be used for contraceptive purposes or for anti-cancer therapy.

The desired antigen to be expressed can be designed so as to give internal, surface, secreted, or budding and assembled forms of the antigens being used as immunogens.

There are numerous advantages for the use of DNA for immunizations. For example, immunization can be accomplished for any antigen encoded by DNA. Furthermore, the DNA encoded antigens are expressed as "pure" antigens in their native states and have undergone normal host cell modifications. Also, DNA is easily and inexpensively manipulated and is stable as a dry product or in solution over a wide range of temperatures. Thus, this technology is valuable for the development of highly effective subunit vaccines.

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CLAIMS

1. A product for use in vertebrate therapy, e.g., immunization, contraception or tumor therapy, and comprising a DNA transcription unit comprising DNA encoding a desired therapeutic agent operatively linked to a promoter region.
2. Use of a DNA transcription unit comprising DNA encoding a desired antigen operatively linked to a promoter region, for the manufacture of a medicament for use in vertebrate immunization by eliciting a humoral immune response, a cell-mediated immune response or both against the desired antigen.
3. A method of immunizing a vertebrate, said method comprising administering to a vertebrate a DNA transcription unit comprising DNA encoding a desired antigen operatively linked to a promoter region, whereby a humoral immune response, a cell-mediated immune response or both is elicited against the desired antigen.
4. Use according to Claim 2 or a method according to Claim 3 wherein the desired antigen is capable of eliciting a protective immune response against an infectious agent.
5. Use according to Claim 2 or Claim 4, wherein the medicament comprises a physiologically acceptable carrier and is adapted to be administered by a route chosen from mucosal, intranasal, intravenous, intramuscular, intraperitoneal, intradermal and subcutaneous.

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6. The method of Claim 3 or Claim 4, wherein the DNA transcription unit, in a physiologically acceptable carrier, is administered to a vertebrate through a route of administration chosen from intranasal,
5 intravenous, intramuscular, intraperitoneal, intradermal and subcutaneous.
7. The method of Claim 3 or Claim 4, wherein the DNA transcription unit is administered to a vertebrate by contacting the DNA transcription unit in a
10 physiologically acceptable carrier with a mucosal surface of the vertebrate.
8. A method of immunizing a vertebrate against an infectious agent, said method comprising administering to a mucosal (e.g., nasal) surface of a
15 vertebrate a DNA transcription unit comprising DNA encoding a desired antigen operatively linked to a promoter region, in a physiologically acceptable carrier, thereby eliciting a humoral or cell-mediated immune response, or both, against the desired
20 antigen, whereby the vertebrate is protected from disease caused by an infectious agent.
9. A product, use or method according to any one of the preceding claims, wherein the DNA transcription unit is of nonretroviral origin.
- 25 10. Use or a method according to any one of Claims 2 to 9, wherein the antigen is viral.
11. Use or a method according to Claim 10, wherein the virus is an influenza virus, e.g., virus hemagglutinin.

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12. A product, use or method according to any one of the preceding claims, wherein the vertebrate is a mammal, e.g., a human.